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JULY, 1904.

The Aëronautical Journal.

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NOTICES OF The Aëronautical Society.

The concluding meeting of the thirty-ninth Session of the Aëronautical Society of Great Britain will be held at the Society of Arts, John Street, Adelphi, on Tuesday, July 12th, 1904, at 8 p.m. The President, Major B. Baden-Powell, will take the chair.

The following papers will be read:—

"Scientific Balloon Ascents," by Mr. Charles Harding, F.R.Met. Soc., Late Vice-President Royal Meteorological Society.

"The Measurement of Air Velocity and Pressure in Aëro-Dynamic Experiments" and "The Balloon Anemometer," by Professor A. F. Zahm, of Notre Dame University, Indiana, U.S.A.

"An Airtight Balloon Car (with diagrams) for High Ascents," by Messrs. Eustace Short and Horace Leonard Short. With lantern illustrations.

THE LIBRARY.

Arrangements have been made for the Library of the Society to be open to members for reference and the borrowing of books on the first Monday in the month from 2 to 5 p.m., except when the first Monday falls on a Bank Holiday in which case it will be open on the following Monday, or when special notice is given to members of change of date. As the second Monday in August falls in the vacation the Library will be open instead on Monday, July 25th, and special notice will be given of the date of re-opening after the vacation.

The following books and publications have been presented to the Library:—By the Smithsonian Institution (Washington): "Some Aëronautical Experiments," by Wilbur Wright. By Royal Astronomical Society, Obituary Notice of James Glaisher, reprinted from the Monthly Notices of Royal Astronomical Society. By the Meteorological Council: "Etude sur les Dépressions Barométriques à Diverses Hauteurs," par L. Teisserenc de Bort. "Observations by Means of Kites at Crinan in the summer of 1903," by W. H. Dines. By Eric Stuart Bruce, "The Use of Balloons in War."

On receipt of the sad news of the death of Major H. C. Roberts a wreath was despatched on behalf of the Aëronautical Society of Great Britain, in expression of their sorrow and sympathy.

ERIC STUART BRUCE,
Honorary Secretary.

THE LATE MAJOR H. C. ROBERTS.

Griefs and sorrows come not singly. The last number of this journal wore the badge of mourning for the loss of Sir Edwin Arnold. Again, its opening pages are darkened by the loss of another councillor of the Aëronautical Society of Great Britain, who was its oldest and deeply-respected member. On May 25th last Major Herbert Charles Roberts passed from our midst. Till within a few weeks of his death Major Roberts was an active worker on the Council of the Society, untiring in his devotion to its interests.

Some secure personal fame by some work which attracts the attention of the outward world. There are others, rarer to find, who prefer to merge their individuality in a cause. Their light, indeed, shines before men, but it shines collectively and lastingly in a communion of workers. Major Roberts was one of these—always ready, well or ill, to give his time to the business of the Society, to be present in emergency, to fill an empty place, to give the benefit of his experience to those who would ask his advice. Perhaps it was his keen sense of justice and consideration of others which not only made him a valuable member of Council, but endeared him to those who had the privilege to confer with him. Ever was he ready to give to others their due. Often he would write the note of appreciation of the special work of another, the more valued in this age of rush, where there is little time to remember yesterday.

It was in 1868 that Major Roberts joined the Aëronautical Society of Great Britain, days when Glaisher was the frequent chairman of its meetings. When Glaisher retired from actively taking part in its proceedings, Major Roberts frequently took the chair at the Council meetings, and many were the minutes signed by his hand. On several occasions in quite recent years he presided at the general meetings.

Some facts concerning Major Roberts' career outside the Society may be of interest to members.

He was the fourth son of Mr. Charles Roberts, of the Indian Civil Service, and grandson of Sir Richard Armstrong, Knight Commander of the Bath, and Knight Commander of the Tower and Sword. He was born at Palamanair, North Arcot, Madras, and brought to England two years later.

In 1845 he obtained a cadetship in the Madras Infantry, and left England to join his regiment, 41st Madras Infantry, in the following year. During his career in India he acted as aide-de-camp to Sir Richard Armstrong when the later was commander-in-chief of Madras, and, after Sir Richard Armstrong's death, as aide-de-camp to Lord Harris, and held other important posts.

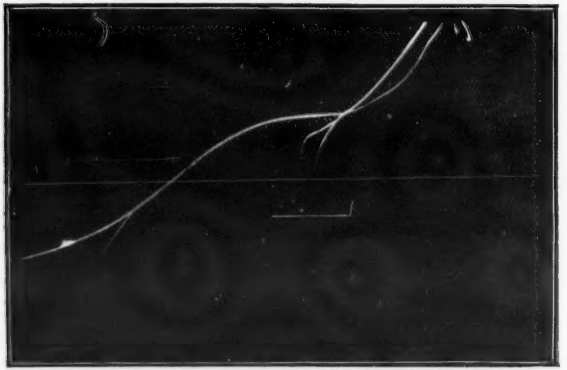
In 1856 he married Miss Elliot, daughter of William Elliot, of Madras Civil Service. In 1860 he retired from the service, and in 1874 the late Lord Derby appointed him comptroller of his house expenditure, and he held this office until Lord Derby's death in 1893.

Major Roberts was a linquist, efficient in various eastern tongues and dialects. He was Hon. Secretary of the Madras Cricket Club during the last seven years he was in Madras, also of the Madras Club for the last two and a half years. He was captain of the Madras Rifle Club from 1861 till he left India. He was a member of the United Service Club and Royal Institution.

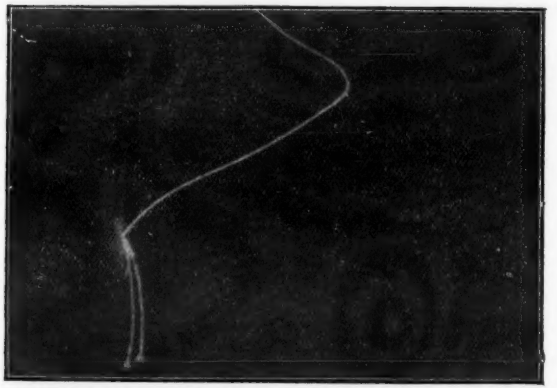
Photographs of the Paths of Aërial Gliders.

By G. H. BRYAN, F.R.S., D.Sc, and W. E. WILLIAMS.

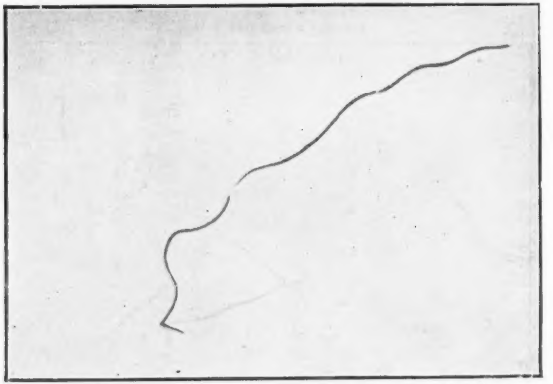
These photographs were taken by attaching magnesium wire to small gliders consisting of square planes and pairs of square planes, and allowing them to descend in front of a camera in a dark room with the wire burning. By placing a rotating wheel in front of the camera, a dotted instead of a continuous track was obtained, enabling the velocities at different points to be compared. When the path is nearly straight, two sets of oscillations are observed. If either of these oscillations increases as the glider descends, the glider will be longitudinally unstable.



(1.) **Single Square Plane.**—Length of Path about three yards.



(2.) **Path of Glider. Single Plane.**—The Curve is the Projection of a helix.



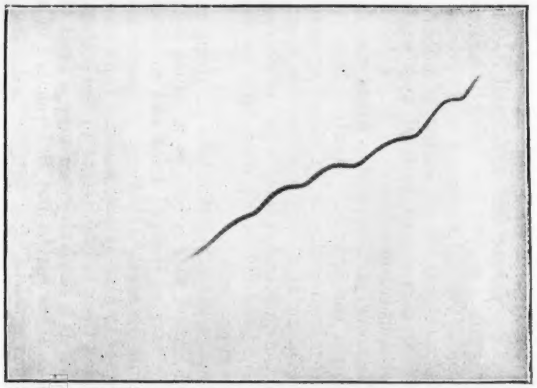
(3.) **Path of Glider.**—Two square planes at a small angle showing instability due to increase of oscillation of small period. Length of path about four yards.

(4.) **Path of Glider.**—Two square planes inclined at a small angle.

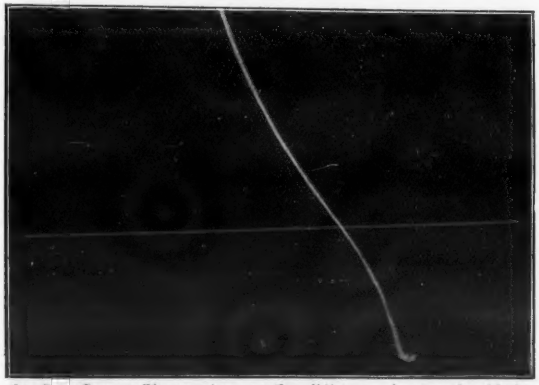
(5.) **Path of Glider.**—Two square planes at a small angle. The oscillations of short period were not started in this case. Length of path about eight yards.

(6.) **Two Square Planes.**

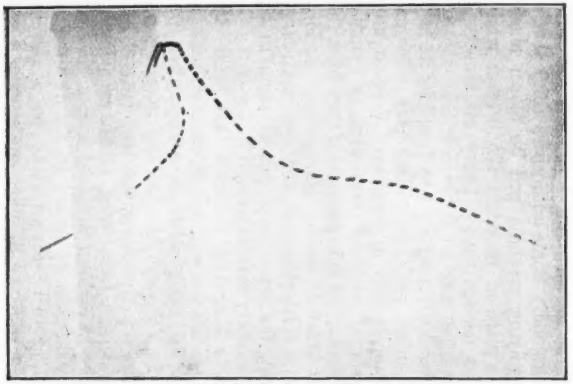
(7.) **Path of Glider.**—Consisting of two square planes set at an angle of 15°. Length of path about seven yards. The drop at left-hand side was caused by glider hitting a bench.



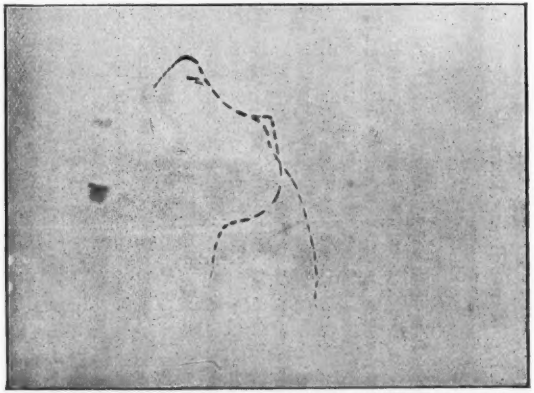
(8.) **Path of Glider.**—Consisting of two square planes inclined at an angle of 10°.



(9.) **Two Square Planes at an angle,** gliding at a large angle with the horizontal.



(10.) **Single Square Plane.**



(11.) **Path of Single Square Plane showing instability.**—Interruptions in curve were caused by a wheel rotating in front of lens of camera, and show relative velocity at different points of path (curve to right caused by a piece of magnesium falling off).

Aeroplane Experiments at the Crystal Palace.

By Major Baden-Powell.

I.

It has often been supposed that one of the greatest difficulties to be overcome before successful aërial navigation can be achieved is the practical balance of the apparatus in mid-air. Whether or not this will really prove a stumbling-block it is impossible, with our present experience, to state with certainty. Several inventors, it is true, have had considerable difficulties in the initial starting of their machines, which have had a way of toppling over as soon as they have been launched into the air. It seems just possible, however, that if the machine could be properly trimmed before starting, all such difficulties might be overcome. We know that small models, if dropped from the hand or lightly thrown forward, will easily upset, if not properly balanced, but which, if the weights be carefully adjusted beforehand, will fly steadily enough on their downward course. But it is extremely difficult to calculate the position of the centres of gravity and of pressure, and practical trial is the only certain method of getting this balance. How, then, is it possible to test practically the balance of a machine which we are loth to launch into mid-air because we are afraid of its toppling over?

With a parachute or surface dropping perpendicularly, the weight should, of course, be in the centre of the area; but if a more or less flat surface be progressing through the air horizontally, it is found that the centre of pressure advances towards the front edge, and therefore, if the weight be in the centre, the plane will rapidly rise in front, and will soon overbalance and shoot down backwards. But the more rapidly the machine is travelling, the more does the centre of effort advance. It would, therefore, seem to be necessary to shift the balance in accordance with the speed. The angle presented by the aëroplane also causes this point to vary, so that experiments with the tilting of the aëroplanes are also necessary.

It is often supposed that, in addition to what we may call the "passive" or "fixed" balance, we must take into account the action of the air currents on the wings. These may be the result both of the eddies caused by the progression of the planes through still air and of gusts of wind blowing against them.

These actions and re-actions are little understood. Some authorities think that a large flying machine will be blown about like a piece of paper in the breeze, while others declare that a heavy machine progressing at a speed far greater than that of the wind will scarcely be affected by it.

Another problem calling for practical solution is that of steering. Vertical and horizontal rudders may seem a simple expedient, but it is doubtful if they form the most efficient means of steering. A bird has no vertical rudder, and tests with large gliding machines have proved them to be not entirely satisfactory.

It is therefore manifest that before we can build a proper airship we must make a series of trials with some apparatus progressing through the air and carrying an aëronaut to direct its course. Several experimenters have tried gliding machines, which have been designed either to soar down the face of a hill in the teeth of a wind, or to be drawn along by a string. But in addition to other drawbacks, these systems have the serious objection of being very dangerous to the operator. Already two of the principal experimenters in this line have unfortunately lost their lives through some small deficiency in their apparatus, and if tried over land there is always the danger that any small mishap may result in the machine losing its balance and precipitating its operator to the ground. Such machines, at all events as hitherto designed, cannot well be tried over water for obvious reasons.

Moreover, such apparatus would usually progress comparatively slowly. Now to support itself in the air an aëroplane must move along at a very considerable speed, and the questions of balance and of steering are undoubtedly much dependent on the rate of progress.

One of the simplest means of giving an initial speed to any body is to cause it to run down an inclined track and to shoot off into the air at the bottom. If means are adopted to prevent the machine from leaving the track before it gets to the bottom, and if it is then projected over a sheet of water, there can be but little chance of a serious accident.

I therefore decided, some months ago, to erect such a track, and conduct a series of experiments. Existing "water-chutes" at once suggested themselves as ready-made

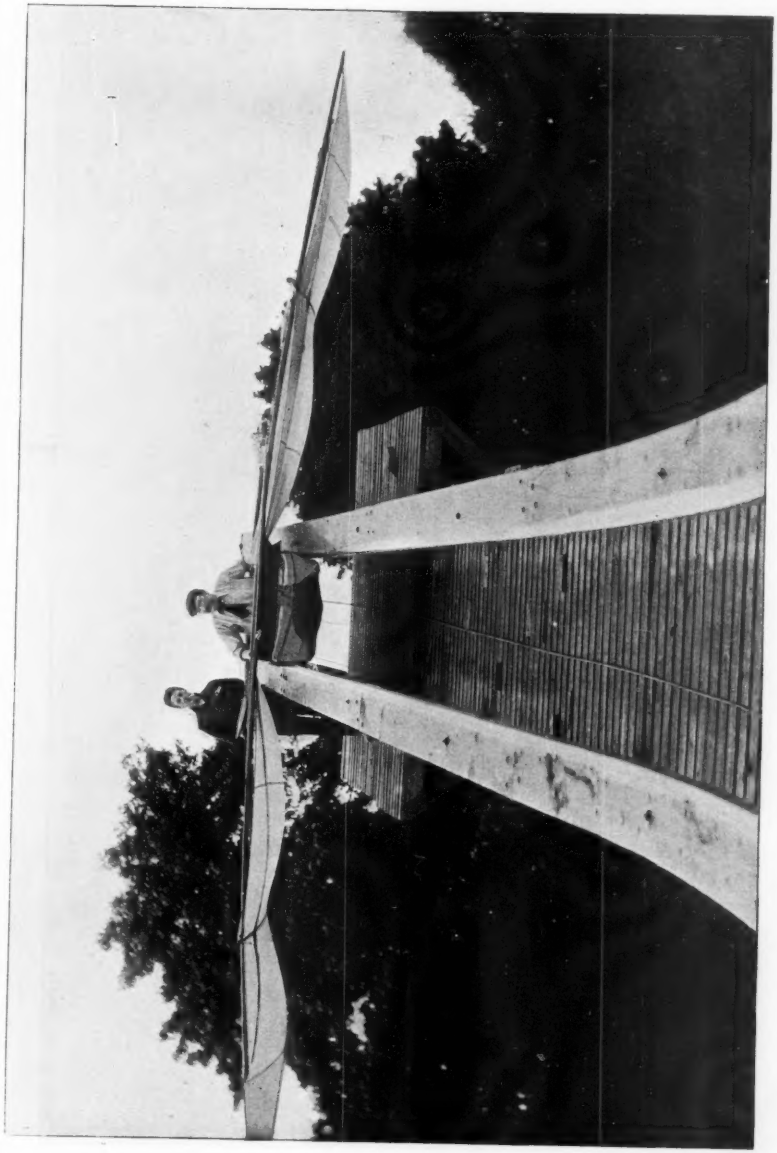


Photo by Russell.

Ready to Start.

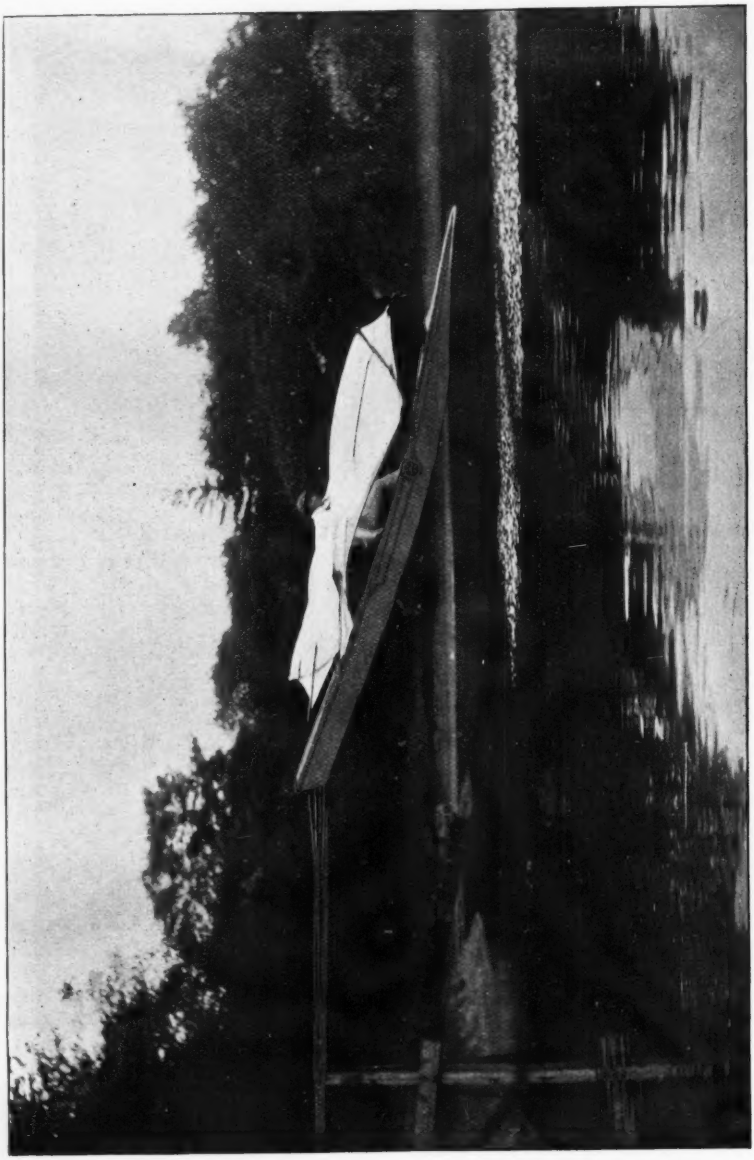


Photo by Russell.

In Mid Air.

[Photo by Russell.

Another Glide.

tracks, but, after examining several, and even making experiments with aëroplanes on them, I came to the conclusion that such were not suitable to the purpose. They are not steep enough to get up sufficient speed, they are not sufficiently turned up at the bottom to shoot the apparatus off in a horizontal direction, and rails and lamp-posts interfere with large wings. Besides, it would be difficult to arrange any method by which the aëroplane could be prevented from rising off the track before arriving at the bottom, which it is very apt to do in gusty weather.

By the courtesy of the Management of the Crystal Palace, the magnificent grounds of that institution have been placed at my disposal, and a most suitable spot was soon found beside the Intermediate Lake. Here I have had a large staging erected.

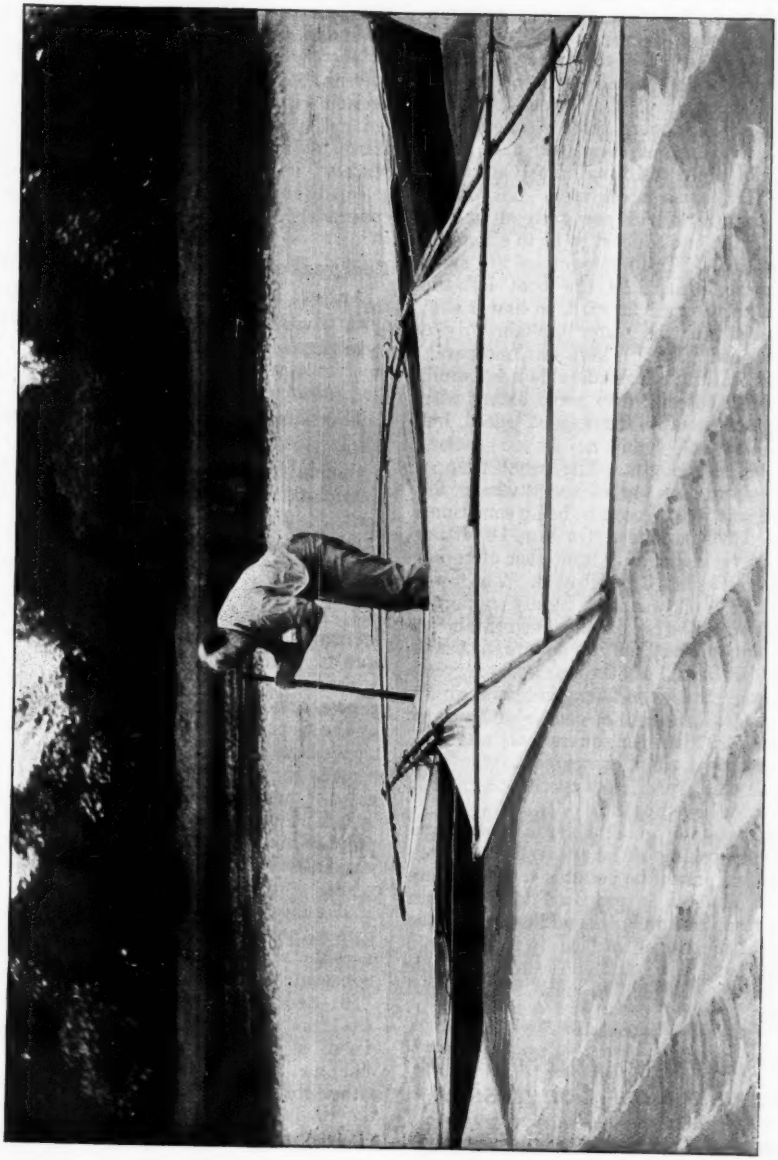
Mr. C. J. Blomfield, the well-known architect, very kindly undertook to superintend the details of construction. The staging is of wood, the upper end being some 30 feet above the level of the lake. The incline is one in two, the lower end forming a curve of 60 feet radius. The "take-off" is on an upward incline of one in ten, the lowest portion of the track being about ten feet from the outer end, which is six feet above the water level.

The rails are composed of solid slabs of oak securely bolted to the structure, and projected inwards so as to allow of runners engaging on their under sides as well as on the upper. They have a gauge of 2 ft. 6 in. These are carefully smoothed and greased to minimise friction. The flying apparatus consists of a boat, flat-bottomed, and with a considerably rockered stem, about 20 feet long over all, by 2 ft. 6 in. beam. From the sides of this project runners of oak to slide on the rails, and also some projections which are to engage the under sides of the rails in the event of the wind lifting the wings on one side, and thus prevent the machine being overturned or lifted upwards off the track.

The rate of descent is found to be 50 feet per second near the bottom, but the speed is, of course, diminished slightly during the upward incline before the boat leaves the track. An electric chronograph is to be fitted so that the speed can be measured over various sections of the track.

II.

Since the above was written many more experiments have been conducted, although we have learnt what a vast amount of small details need alteration and adjustment before good results can be obtained. Repeated trials showed that the boat sliding down between the inclined rails did not nearly attain the speed which it should have accomplished according to theory, and it was only after many days that one cause of this was discovered. Although the gauge of the track had been carefully tested on completion, and though the inside of the rails appeared to be perfectly straight, a subsequent measurement of the gauge, after the structure had been subjected to many days' alternate sunshine and rain, proved that the wood had swollen and warped so that there was a slight contraction about half way down. This was just sufficient to cause the boat, in its descent, to become slightly jammed between the rails, but not sufficient to stop its way, so that to all appearances the apparatus simply ran very slowly. This difficulty was, of course, soon overcome by planing away about $\frac{1}{4}$ inch from the inside of the rails. Then various trials with different forms of lubrication for the runners showed difficulties with this method, and resulted in the application of small wheels to the sides of the boat in place of the oak runners. The track itself was also altered, as it was found that the "take off" at the lower end was rather too steeply inclined and detracted from the speed. On June 8 the first trials were made with a man in the boat, and several fairly successful descents were made, both by Mr. J. T. C. Moore Brabazon (who has kindly given me most valuable assistance in these trials) and by myself. The size of the aëroplanes used on this occasion was insufficient to make a good glide, the total weight of the apparatus amounting to some 270 lbs., and the area of the aëroplanes (each 12 ft. by 5 ft. 6 ins.) to only 132 square feet. It was considered desirable to try the apparatus with this small aëroplane, with the object of testing the strength of all parts, and in this respect the results were most satisfactory. The boat, consisting of rough boards and battens screwed and nailed together, covered with canvas, stood a lot of very rough usage, and scarcely suffered at all from its plunges into the water. The aëroplanes were of thin cambric, stretched on bamboos of about $1\frac{1}{2}$ ins. diameter at the butt ends. These were fixed to the boat, but otherwise not stayed or trussed in any way; and though they bent upwards considerably during the descent through the air, proved to be amply



Paddling Ashore After Descent. [Photo by Russell.

strong enough for the work. By constructing the wings on this principle instead of so staying them as to be rigidly horizontal, an advantage was gained in that, while on the track, the ends were not caught by any side wind, and yet, while supported in the air, a considerable diedral angle was formed which gave the desired transverse stability. On June 13, some larger aëroplanes were fitted. These were of hexagonal shape (being, in fact, constructed of old man-lifting kites), and were each of 118 square feet area. The lower end of the track had now been altered by removing the end support so as to allow the ends to droop. The photographs will show this arrangement. As the boat left the track, it was canted forward, so that it shot downwards into the water too abruptly to make a good glide. There was, moreover, on this occasion, a considerable head wind, which often interfered to some extent with the apparatus attaining a good speed, but which was not found to be so serious as might be thought. The usual time of descent from the top of the track to the take-off was just 3 seconds, being sometimes extended to 3½ seconds. On June 18 further trials were made, after a number of minor improvements had been effected. The lower end of the track was now rigidly supported and set so as to be exactly horizontal. A triangular "beak" of 18 square feet was spread in front of the same hexagonal aëroplanes, and some fairly successful glides were made, although, of course, the weight per area (1·24 lbs. per square foot) was still very excessive when compared to the proportions which previous experimenters with aëroplanes have applied.

Now that the general arrangement and practical working of the apparatus has been well tested, it will be possible to make more exact trials. It is proposed to fit on an upper aëroplane and other additions to make the total supporting surface up to some 430 square feet, and it then seems probable that we may be able to make some useful glides.

Forthcoming International Aëronautical Congresses.

Students of aëronautics who wish to avail themselves of the advantages of international discussion of those many subjects which are directly or indirectly concerned with the various branches of the science and on the better understanding of which progress will depend, will have abundant opportunities this autumn. From August 29th to September 3rd will be held the Congress of the International Scientific Aëronautical Commission at St. Petersbourg, and on October 3rd, 4th and 5th will be held the International Aëronautical Congress in connection with the St. Louis Exhibition.

By the courtsey of the respective secretaries, we are enabled to place before our readers the programme of the topics selected for papers and discussion at both congresses.

Congress of the International Scientific Aeronautical Commission, to be held at St. Petersburg from August 29th to September 3rd, 1904.

PROGRAMME.

Translated by Helen Auxilium Bruce.

I.

General report by the President of the Commission.

II.

QUESTIONS TO BE DISCUSSED.

A.—General Organisation of the International Observations.

1. The consideration of suitable measures to insure an international fund to cover the cost of publication of the results of the international ascents. Hitherto these expenses have been met from a grant made by the German Government. Those countries that take part in the international ascents should positively contribute to the costs of publication. (Hergesell.)

2. The consideration of changes in the programme of the international ascents warranted by the experience of the last few years.

The discussion of Herr Hergesell's proposal that certain of the international ascents should be extended over several consecutive days. (Hergesell.)

3. Reductions and alterations proposed, as the result of publication experience, in the form of publication of the accounts of ballons sondes, manned balloons, and other observations.

(Hergesell and de Quervain.)

4. A fresh agreement as to the instrumental equipment of the international ascents, so as to facilitate uniformity and comparability between the various instruments used. (Hergesell.)

5. Practical means of recovering Ballons Sondes. Statistics of the losses of the various countries. (Teisserenc de Bort.)

6. A thorough discussion of the merits of Hair Hygrometers, and their employment in the instruments of Ballons Sondes. (Maurer.)

7. The preparation of a uniform programme for the observations of mountain and cloud stations, made on the International Ascent Days, and an agreement as to the necessary means of obtaining comparability between cloud observations. A resolution to support, as most desirable, a new edition of the International Cloud Atlas. (de Quervain.)

8. A consideration of the organisation of electric and actinometric observations in manned ascents. (Kousnezov.)

9. An attempt to avoid Customs House difficulties in transport of scientific apparatus. (Moedebeck.)

B.—Special International Undertakings.

1. What measures shall be taken to carry out the resolution of the Berlin Conference, subscribed to by the International Meteorological Committee, to organise super-oceanic observations in the upper atmosphere. (Rykatchew.)

2. The interest that would attach to the establishment of more International Aëronautical Observatories, such as those of Blue Hill, Trappes Tegel, Pavlovsk, &c., with the object of continual observations in the free and open atmosphere. (Hergesell.)

3. An investigation of the question whether the data of aëronautical observatories can be directly utilised for weather forecasts, and how this could be brought about. (Gross.)

4. The organisation of a series of prolonged aërial scientific journeys in a specially constructed balloon, of which the equipment would be international. (Gross.)

5. The possibility of regular Kite Flights on the routes of the great steam liners, and the starting of some preparatory attempts. (Moedebeck.)

C.—Special Scientific Researches.

1. Report on the scientific ascents which have been made in Italy, and the presentation of the published results. (Palazzo.)

2. The new aëronautical observatory at Lindenburg. (Assmann).

3. The temperature of the atmosphere above Berlin based on the continuous ascents made since August, 1902. (Assmann.)

4. The results of the wind observations made up to now at the aëronautical observatory at Tegel. (Berson.)

5. The practical possibility of exact determinations of astronomical position in a balloon and the combination of this method with that proposed by M. Eschenhagen, which is based on terrestrial magnetism. (Berson.)

6. Report on Dr. Elias' experiments in registering atmospherical electricity at the Aëronautical Observatory. (Elias.)

7. The presentation to the Committee of the results obtained in the Russian Aëronautical Observatories by their flights of Manned Balloons, Ballons Sondes, and Kites. (Rykatchew, Kovanjko, Kousnezov.)

D.—Technical Questions.

1. A discussion of the means, methods, and appliances, for attaining safely great heights in Manned Balloons. (Kovanjko.)

2. Graduating simplified to permit of reading thermometers at a distance in Manned Balloons. (V. Bassus.)

3. The measurement of gas temperature inside balloons in captive and free ascents. (Gross.)

4. The wholesale and cheap manufacture of model receiving instruments. (Moedebeck.)

5. The protection of free and captive balloons from lightning. (Gross.)

6. The perfecting of Kite Balloons for meteorological use by the combination of surfaces of kites to permit of still higher ascensions. (Gross.)

III.

Members of congress will be invited to visit the Instructional Aërostatic Park at St. Petersbourg and the Constantine Observatories at Pavlovsk and Kronstadt; and balloon ascents and kite flights will be organised from a vessel in the Gulf of Finland.

IV.

Several balloon ascents and kite flights will be also organised during the sitting of the Commission, to test various appliances which will be brought forward at the congress, and to carry out some special experiments.

The St. Louis International Aeronautical Congress.

TOPICS SUGGESTED.

1. The best rules of design for dirigible balloons; to include the shape, the materials, the motor, the propeller, and computations of probable speeds.

2. The designing of flying machines; with rules for computing the support, the resistance, and the speed.

3. The rationale of soaring flight, with computations of the forces in action and the manœuvres required.

4. The friction of air upon various surfaces, based upon experiments or upon theoretical considerations.

5. Resistance and supporting power of air, including results, of recent experiments; formulæ for the resistance of balloons or flying machines, &c.

6. Best forms of aërial propellers, including results of experiments with screws, wings, or other forms; their efficiency and the power required.

7. Motors for aëronautical purposes, whether steam, gaseous, electric, explosive; their effectiveness, safety and weight, per horse power.

8. Materials for aëronautical construction, whether for balloons or flying machines, including the strength and weight of fabrics, metals, wood, &c.

9. Best structural forms for aëronautical constructions, so as to combine strength and lightness; to offer the least resistance to progression, and to alight safely.

10. Behaviour of air currents, including observations at various altitudes, the prevalence, the direction, the trend, and the force of winds, &c.

11. Observations and experiments in the flight of birds, including their methods of rising, gliding, alighting, &c.; measurements of power exerted and of velocities.

12. Various types of proposed flying machines, their advantages and defects; the power required; their safety; differences between natural and artificial wings, &c.

13. Equilibrium of flying machines, including the best means of securing safety with wings, screws, aëroplanes, &c., in rising, sailing, and alighting.

14. Novel experiments in aviation and their results, either with power machines, dirigible parachutes, gliding or soaring, models, &c.

15. Experiments with kites; results of different forms as to stability, sustaining power, height attained, behaviour, &c. A history of kites.

16. Construction of balloons, choice of fabrics, laying out, cutting and sewing, varnishes, nets, cars, valves, guide ropes, parachutes, &c.

17. Inflation of balloons; hydrogen, coal gas; natural gas; hot air, &c.; their generation, cost, and management during inflation.

18. Navigable and war balloons, past experiments and results; the present status; the resistance, propellers, motors, speeds, &c.

19. Manœuvring of balloons, ascending and descending, with least expenditure of ballast or gas; utilizing wind currents, and determining altitudes.

20. Observations in balloons, meteorological, photographic, topographical, military, naval, planimetric, &c., various instruments required.

21. The shape of supporting surfaces for kites, gliding or flying machines; planes *versus* curved surfaces.

22. The dangers from gusts and whirlwinds, and how to avoid them.

23. The details of starting and stopping balloons or flying machines.

24. The possible use of storage batteries in airships.

25. Dangers from fire with dirigible balloons.

Communications respecting the congress should be made to Professor A. S. Langsdorf, Secretary, Washington University, St. Louis, Mo.

The St. Louis Aeronautical Competitions.

Notice has been received from the authorities of the St. Louis Exhibition that a change has been made in the rules and regulations previously published in this journal as follows:—

"If a speed of fifteen miles only is attained by the successful competitor the prize will be 50,000 dollars. Provided that if his first successful flight is made before July 1, 1904, the prize shall be 60,000 dollars instead of 50,000 dollars.

"If the speed attained under the rules reaches eighteen miles an hour the prize will be 75,000 dollars. If the speed attained reaches twenty miles an hour, in accordance with the rules, the prize will be 100,000 dollars.

REVIEWS.

Aerial Navigation.

By Octave Chanute, C.E.

Paper Read Before the American Association for the Advance of Science.

There is, perhaps, no opinion of the progress in the engineering of balloons and aëroplanes that we so much value as that of Mr. Octave Chanute, for the very reason that he has made so profound and exhaustive a study of the subject. So many writers on aëronautical problems have displayed a one-sidedness, that it is a relief to the aspirant after truth to have unrolled before him a bird's eye view undistorted by bias or prejudice. Mr. Octave Chanute's paper on Aërial Navigation, delivered before the American Association for the Advance of Science on December 30 last, and re-printed in the *Popular Science Monthly*, is only a few pages in length, but those who wish to gauge the amount of progress in aërial navigation made during the last few years will do better to select to read these few pages than the whole of many of the more popular volumes on the subject whose prominent feature is the pictorial illustrations.

Mr. Chanute calmly but decisively speaks of the progress made by both those who use the body lighter than air and those who use the body heavier than air. The facts he has collected concerning the vital details of navigable balloons from the experiments of Giffard in 1852 to those of the brothers Lebaudy, and of the British workers whose names are familiar to us, will be found valuable to those studying the subject. In most cases the reader will find the length, diameter, horse-power of motor, and speed attained stated. In the historical sketch of navigable balloons, he does not fail to include the details of those machines which were conspicuously less successful, or attended with disastrous results, or destined to remain untried, such as the balloons of Duprey de Lome, of the ill-fated Dr. Wolfert and General Mesurier's balloon of the French War Department. This latter is often forgotten in the records of airship development. It was said to be 230 feet long, 30 feet in diameter, 120,000 cubic feet in capacity, and to have been provided with a gasoline motor of 45-horse power. It is pointed out that with the reduction that has since been made in gasaline motors, this airship could have carried an engine of 70-horse power, and attained a speed of 30 miles an hour, which is greater than that of Transatlantic steamers. Mr. Chanute criticises the Zeppelin airship as being of inferior shape, the form being a cylinder with paraboloid ends. The lifting power was frittered away on a framework of aluminium, so that the gasoline motor could be of only 32 horse-power. Regarding the shape of navigable balloons, it is interesting to note that Mr. Chanute thinks that the best shaped navigable balloon yet constructed was that of Messieurs Krebs and Renaud, which made five return journeys in 1885.

Mr. Chanute gives a brief account of M. Santos Dumont's airships. He seems to think that the manufacture of so many balloons one after the other might have been rendered unnecessary had he studied carefully what had been found out by his predecessors. As it was, he had to learn by experience, and had to make no less than five airships before he launched the No. 6, with which he won the Deutsch prize.

For the sake of historical accuracy we are bound to point out one error, presumably a slip in the print. It is stated that M. Severo built in 1902 a navigable balloon which was so injudiciously constructed that the car broke away in the air, and the inventor was killed, as well as his engineer, and that later in the same year De Bradsky built a navigable balloon equipped with a gasoline motor located so near the vent for the gas that the latter took fire, exploded the balloon, and the inventor and his engineer were killed. But the facts are that it was Severo who built the balloon which caught fire, and De Bradsky the one that parted from the car.

Mr. Chanute considers that the balloon of the brothers Lebaudy has achieved much success. It has beaten the speed of Santos Dumont, having on many occasions, it is said, attained 24 miles an hour.

In the course of Mr. Chanute's remarks about flying machines he mentions that the data for the full-sized flying machine of Professor Langley, which was tested, October 7 and December 5, have not been published. From newspaper photographs it appears to be an amplification of the models which flew successfully in 1896, and this would necessarily make it very frail. He thinks the failure must have been caused by the launching gear, and does not prove that this machine is worthless. Like the failures of others, it indicates that a

better design must be sought for, and that the first requisites are that the machine shall be stable in the air, shall be quite under the control of its operator, who should learn to manage the machine before attempting to fly with it. This latter remark may seem to be paradoxical, but it was the kind of practical efficiency acquired by the brothers Wright, whose flying machine was successfully tested on December 17. For three years they experimented with gliding machines, and it was only after they had obtained thorough command of their movements in the air that they ventured to add a motor. Mr. Chanute considers that too much praise cannot be awarded to those gentlemen. "Being accomplished mechanics, they designed and built the apparatus, applying thereto a new and effective mode of control of their own. They learnt its use at considerable personal risk of accident. They planned and built the motor, having found none in the market deemed suitable. They evolved a novel and superior form of propeller; and all this was done with their own hands, without financial help from anybody."

Mr. Chanute thus speaks of possible uses and limitations of a successful flying machine:

"Now that an initial success has been achieved with a flying machine, we can discern some of the uses of such apparatus and also some of its limitations. It doubtless will require some time and a good deal of experimenting, not devoid of danger, to develop the machine to practical utility. Its first application will be military. We can conceive how useful it might be in surveying a field of battle, or in patrolling mountains and jungles, over which ordinary means of conveyance are difficult. In reaching otherwise inaccessible places such as cliffs, in conveying messages, perhaps in carrying life-lines to wrecked vessels, the flying-machine may prove preferable to existing methods, and it may even carry mails in special cases, but the useful loads carried will be very small. The machines will eventually be fast, they will be used in sport, but they are not to be thought of as commercial carriers. To say nothing of the danger, the sizes must remain small, and the passengers few, because the weight will, for the same design, increase as the cube of the dimensions, while the supporting surfaces will only increase as the square. It is true that when higher speeds become safe; it will require fewer square feet of surface to carry a man, and that the dimensions will actually decrease, but this will not be enough to carry much greater extraneous loads, such as a store of explosives or big guns to shoot them. The power required will always be great, say something like one-horse power to every hundred pounds of weight, and hence fuel cannot be carried for long single journeys. The North Pole and the interior of Sahara may preserve their secrets a while longer.

"Upon the whole, navigable balloons and flying-machines will constitute a great mechanical triumph for man, but they will not materially upset existing conditions as has sometimes been predicted. Their design and performance will doubtless be improved from time to time, and they will probably develop new uses of their own which have not yet been thought of."

NOTES.

M. Santos Dumonts' No. 7. — The No. 7 Balloon with which M. Santos Dumont will compete for the St. Louis prize is 160 feet long and 23 feet in diameter. It is provided with a motor of 60-horse power with four cylinders capable of making 1,200 revolutions a minute. In a recent article in the *Globe* comment is made upon the dangerous proximity of the motor to the gas bag in the new balloon the distance being 6 feet, but the writer adds that "if considerations of this kind weighed with Santos Dumont he would long ago have ceased his daring experiments. He is not reckless, for I have more than once seen him steadfastly refuse to go up when the wind was too high or the meteorological conditions were of such a nature as to make an ascent in his airship dangerous. But once in the air he has no fear of anything. One of the most exciting moments I ever passed was at St. Cloud on a summer day, when the young Brazilian was returning through space after an aërial excursion in the Santos Dumont No. 5. The flying machine was almost above its shed in the Parc d'Aërostation, and the spectators who had been watching its graceful revolutions and admiring the navigator's control of his huge craft were waiting for the descent. Suddenly Santos Dumont was seen to clamber out of his little car to the slender framework supporting the motor. If he had slipped or if a sudden gust of wind had struck the balloon and caused him to lose his

hold, he must have plunged downward three hundred feet to destruction. The spectators held their breath and shuddered, and when the aëronaut regained his car in safety they gave vent to a hearty cheer. I afterwards learnt that one of the coupling wires had become jammed against the side of a pulley. It was a most dangerous thing to try to free it but Santos Dumont did not hesitate for a second."

New Aeronautical Motor. — "*Commercial Intelligence* gives details of a new aëronautical motor remarkable for its light weight in proportion to its power. It has recently been built by a power company of Philadelphia for a New England aëronaut. By brake test it delivers 40-50 horse-power at 900 revolutions a minute, and since it weighs complete slightly over 200 lbs., the weight per horse-power is less than 5lbs. The spark oil battery, fuel, land water tanks add about 32 lbs. to its weight. It practically consists of two three-cylinder gasoline motors, placed opposite to one another, and acting on a three-throw crank shaft to give a mechanical balance. The cylinders are 4·5 inches in diameter by 5·5 inches long, and the inlet of exhaust valves on each cylinder may be removed by the loosing of a single nut. For lubrication purposes the crank shaft and shaft pins are hollowed. The jumping spark system of ignition is used with a single coil for all the cylinders and a commentator for switching the current to each one of the six in order. It is claimed that the motor is the lightest for its power yet constructed.

M. Teisserenc de Bort's Kite-Flying Experiments.—Mr. Lawrence Rotch, in a communication to *Science* July 24th, 1903, gives the following details, of M. Teisserenc de Bort's kite-flying experiments:—"A most remarkable campaign has been conducted by M. Teisserenc de Bort, who, with the aid of Scandinavian colleagues, established last summer a kite-flying station in Jutland, Denmark, where aerial soundings were made day and night, wind permitting, during nine months. After the termination of this work the apparatus was transferred to a Danish gunboat, and on a cruise in the Baltic Sea the following extraordinary results, which have been communicated by the director, were obtained on five consecutive days: April 22nd, at an altitude of 9,450 feet, a temperature of 14°·8 F. was found; April 23rd, at 13,500 feet, the temperature was 9°·1; April 24th, at 4,660 feet, 38°·3. On April 25th, an altitude of 19,360 feet, which is probably the greatest height ever reached by a kite, was exceeded, and an instrument on the lower portion of the wire, at a height of 7,415 feet, recorded 24°·4. In this flight the total length of the wire was 38,000 feet, and the upper 4,000 feet, with the highest registering instrument, broke away, but were recovered. On the morning of April 26th, an altitude of 8,140 feet, with a temperature of 15°·2, was obtained, and in the afternoon 13,320 feet, with a temperature of 3°·2. Since the gunboat steamed only 9½ knots, the kites could not be flown when there was a complete absence of wind." Mr. Lawrence Rotch considers that these experiments amply prove the practicability of his project to investigate the atmospheric strata lying above the doldrums and trade-winds by means of kites flown from a specially-chartered steamer. "This plan, which was outlined in *Science*, received the approval of the International Aëronautical Congress at Berlin last year, and an application for a grant to aid its execution is now before the trustees of the Carnegie Institution. Although the German, British, and Scottish Antarctic Expeditions were equipped with meteorological kites, the reports received confirm the prediction of the writer that little use would be made of them during the voyages southward. On the vessel which the Baltimore Geographical Society sent last month to the Bahamas, Dr. Fassig, of the Weather Bureau, expected to fly kites, but owing to the substitution of a schooner for a steamer this could not well be done, and, therefore, the kites were probably flown only at Nassau. It is to be hoped that Dr. Fassig has obtained observations of temperature and humidity in the trade-winds which, even if he did not succeed in getting through, owing to their becoming light above, will be of considerable value. The observations might serve as a starting point for the work of the expedition proposed by the writer, which would proceed across the equator and be capable of sounding the atmosphere to the height of four miles, notwithstanding the fact that winds either too light or too strong for the kites may be encountered when the steamer is stationary."

The Balloon Explosion in Paris.—A somewhat extraordinary balloon accident, though apparently not without pre-

cedent, occurred in Paris on May 11. A large balloon, surnamed Le Surcouf, manned by M. Victor Bacon, weighed down by heavy rains, descended in the Rue Edouard-Robert, off the Avenue Daumesnil, and when it reached the ground exploded, injuring twenty persons. The accident has been ascribed to many causes. Some say it was a passer by who was smoking who, by his pipe, ignited the escaping gas; others that the occupants of the houses brushed by the balloon rushed to the windows. Other accounts say it was the fires in the houses which set fire to gas pouring in by the open windows. These are all possible causes, but *Engineering*, in an account of the accident, suggests another and more recondite one. It reminds us that in 1898, the balloon Humbolt caught fire when coming near Berlin. Smoking was suggested as the cause, but it was proved that one of the aëronauts had jumped out and brought his hand up to the valve string to open it fully. The balloon had a static electric charge, and a circuit to earth being nearly established by the aëronaut, a spark passed. Boernstein and Baschin investigated the phenomenon with the balloon Phœnix, and came to the conclusion that the varnished silk was particularly apt to become electrified. It was pointed out later by Captain Von Tschudi that the hydrogen forced out of the balloon would also become statically charged. In 1902, the Jupiter exploded near Vienna. In this case, the aëronaut stifled the flame by pressing the balloon on the ground. In 1903, the Passewitz, a Berlin balloon, was destroyed on touching ground. There were two explosions, no one had left the balloon car, and the aëronaut was holding the wet valve cord. *Engineering* points out that it may be objected that in the case of the recent Paris accident the heavy rain would have prevented the accumulation of any charge, but it also points out that the precipitations themselves may be electrified. This is a subject which Gadien is now thoroughly investigating at Gottingen. It is now known that it is not the humidity of the air which produces leakage of electric charges, but the state of ionisation; a fact confirmed last winter by Mr. John Don, at Peterhead Academy, with the aid of his electroscope. These facts collected by *Engineering* tend to show that whether or no the late Paris accident can be traced to electricity, the electric charge on balloons may be a grave danger, and should call for urther investigation.

Experiments with Man Lifting Kites at Aldershot.—Mr. S. F. Cody has lately been engaged in displaying the powers of his man lifting kites at Aldershot. It is stated that several of the officers of the balloon section have made ascents on these kites, and that Lieutenant Holwell was lifted to a height of 1,000 feet. Mr. Cody has certainly proved that the kite may be of service for observation in war, and that on windy days, when captive balloons fail, reconnaissance from an altitude need not stop. Further details of the admirable work achieved by Mr. Cody are reserved for a future number of this journal.

Balloons and Kites in the War in the East.—It is understood that balloons and kites are largely represented in the present war in the East, it being the first in which kites have been used for observation purposes. Recent telegrams report the use of kites by the Japanese at the battle of Kiuliencheng, when by the aid of kites, they were able to correct their artillery fire, which was thereby rendered extraordinarily accurate and effective.

Foreign Aeronautical Periodicals.

(In this list a selection of some of the most notable articles is given).

L'Aeronaute (Paris).

April, 1904.—Dirigéable de MM. Philippe et Lebrun, de Bizerte—un Centenaire—Concours d'Aviation.

L'Aerophile (Paris).

May, 1904.—Portraits d'Aeronautes contemporains: Alfred Wonwiller; Henry de la Vaulx—Les ballons porte-amarres Henri Hervé; A. de Masfrand Dispositions mécanique A. de Dion pour aéronats; système compensateur A. de Dion pour aéronats; A. Clérey—Un Monument à Banal et Bixio; Besançon.

Illustrierte Aëronautische Mitteilungen (Strassburg).

April, 1904.—Uber die Bedingungen unter denen die Ortsveranderung eines ballons elektrische Ladungen auf ihm hervorbringen Kann; Von Wilhelm Volkmann—Drachenaufstiege auf der Ostsee, den Norwegischen Gewässern und dem Nördlichen eismeere; Von Arthur Berson und Hermann Elias.

May.—Die Neuen Motore für Graf v. Zeppelins Luftschiff. Die Versuchsergebnisse Von Hargraves Maschine, Nr. 25.

June. — Die Widerstandserscheinungen in flussigen medien; Von Prof. Dr. Fr. Ahlborn.

WIENER LUFTSCHIFFER-ZEITUNG (Vienna.)

April —Maritime Versuche Die Unmöglich keit der Avietik; Von Paul Pacher, Prof. Georg Wellner.

June.—Zwanzig Jahre Deutscher Militar-Luftschiffahrt.

Current Aeronautical Articles.

1904.

April 2. *The King and his Navy and Army.* "How Our Ancestors Travelled on the Land and in the Air." (Illustrated.)

— *Daily Mail*, "New Motor Balloons."

13. *Daily Express*, "Tobogganing Through the Air."

May 11. *Globe*, "Military Matters" (War Balloons).

25. *Cassell's Saturday Journal*, "A Chat with Miss Gertrude Bacon."

28. *Daily Chronicle*, "Mechanical Flight."

June. *Macmillan's Magazine*, "The Balloon in Warfare," by Rev. J. M. Bacon.
World's Work, "Flight in 1904."

10. *Morning Post*, "Interesting Balloon Ascents."

13. ———— Major Baden-Powell's Aëroplane Experiments.

15. *Sketch*, "The Delights of Ballooning."

16. *Morning Post*, "The Way of the Winds."

18. *New York Herald*, "Balloon and Auto Hunt."

21. *East Anglian Times*, "Ipswich Balloon Ascent."

Applications for Patents.

(*Made in April, May, and June, 1904.*)

7639. March 31. JAMES WESTAWAY. Improvements in or Connected with Aerial Navigation.

8100. April 8. HERMAN KLEINERT. Safety Airship and Moving Device.

10062. May 2. WILLIAM GLENDENNING. Improvements in or Relating to Navigable Aerial Machines.

11011. May 12. JOHN WILLIAM DUNNE. Improvements in and connected with aeroplanes, aerostats, kites, parachutes, flying machines, and other aeronautical apparatus.

11181. May 14. TRAJAN VUIA. Improved aeroplane motor.

11746. May 21. CHARLES MORRELL HOLMES. Improvements in Flying Kites and other Aerostats.

12503 June 2. FRANCIS ALEXANDER BARTON. Improvements in Navigable Aerial Machines.

13448. June 14. EDMUND KRENEDITS and FRANCOIS DE UDVARY. Improvements in or Relating to Apparatus for Driving Vessels in Air or Water.

13450. June 14. EDUARD ANDERSON. Improvements in or Relating to Flying Kites.

13461. June 14. GEORGE SPICER HILLER. A Device for Utilising the Resistance of Air or Water Caused by the Speed of a Locomotive, Boat, Airship, or Other Moving Body to Drive Machinery on said Locomotive, Boat, and the Like.

13502. June 14. ANDRE DELPRAT. Flying Ships with Flapping or Paddling Wings.

13747. June 17. EDWARD BENSTON. Improvements in Flying Machines and Navigable Balloons.